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Li

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(54) **CABLE BACKPLANE**

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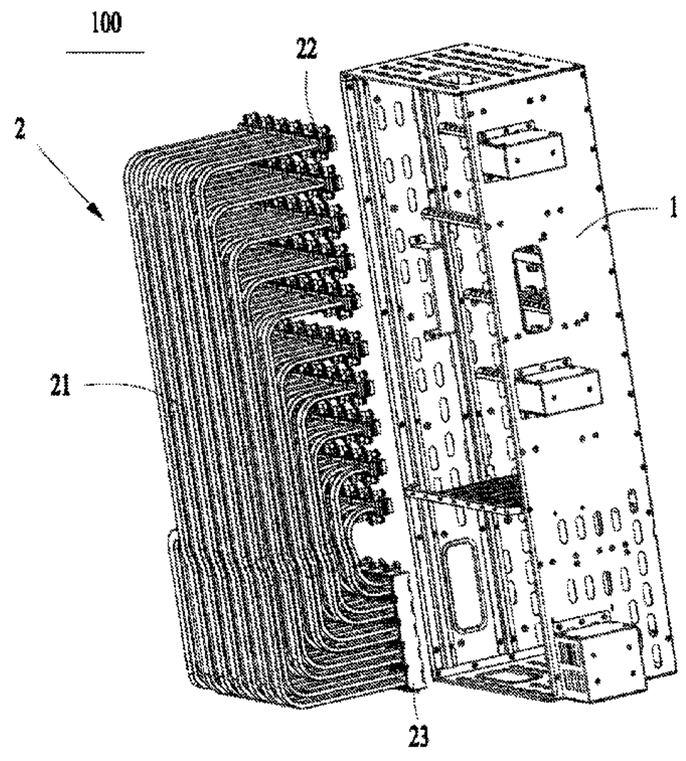
(57) **ABSTRACT**

Cable backplane systems and communication devices are provided according to examples of the present disclosure. In one aspect, a cable backplane system includes a frame and a cable unit; the cable unit includes a first connector array, a second connector array and communication cables; the first connector array is fixed on the frame, wherein a first connector in the first connector array is connected with a first plug-in card, first connectors in a same row are connected with a same first plug-in card; the second connector array is fixed on the frame, wherein a second connector in the second connector array is connected with a second plug-in card, second connectors in a same column are connected with a same second plug-in card; and the communication cables is connected with the first connector array and the second connector array.

9 Claims, 12 Drawing Sheets



(51) **Int. Cl.**

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H05K 7/10	(2006.01)
H01R 31/06	(2006.01)
H01R 27/02	(2006.01)
H04Q 1/02	(2006.01)
H01R 12/75	(2011.01)

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USPC 439/61, 540.1
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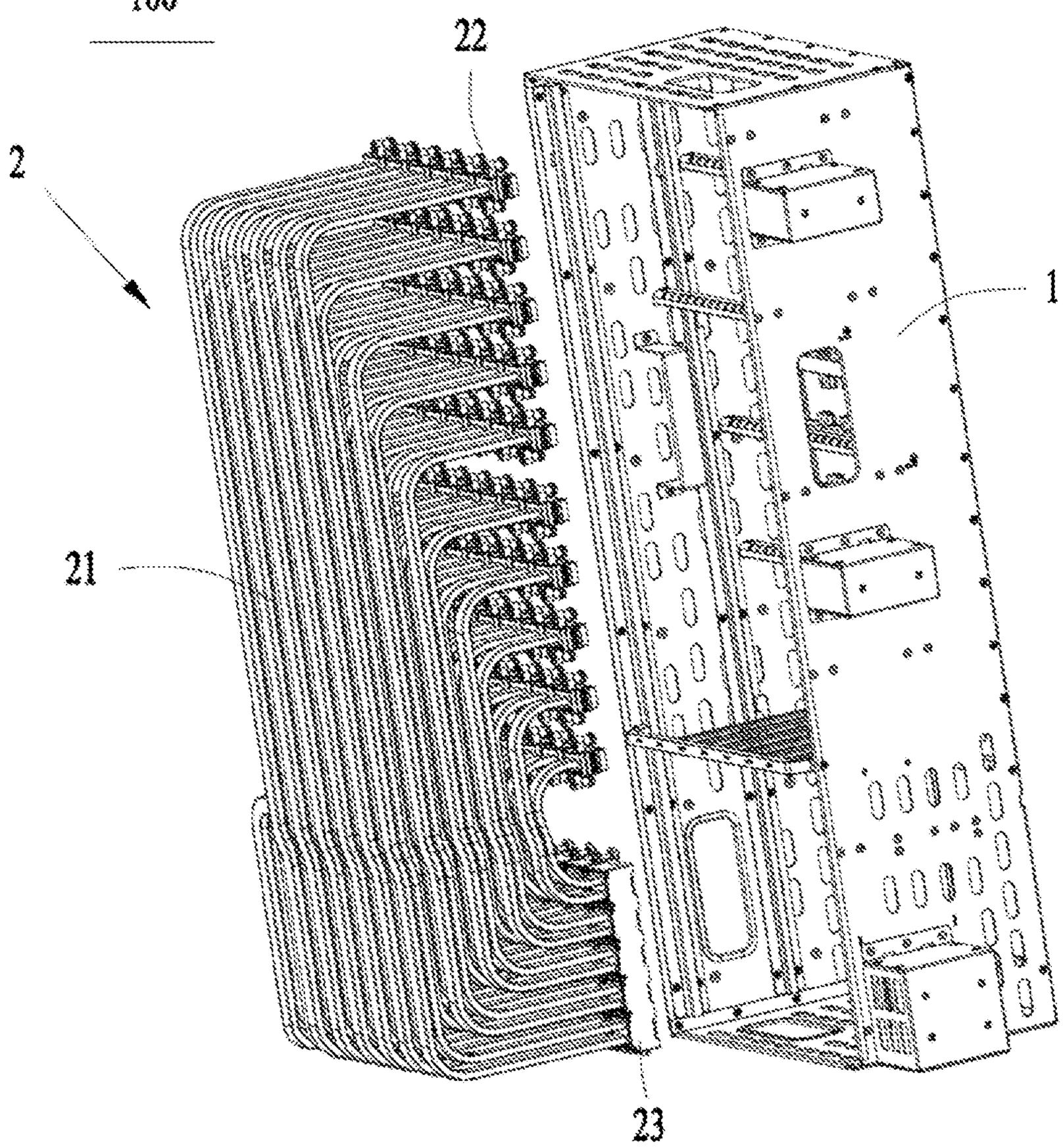

FIG. 1

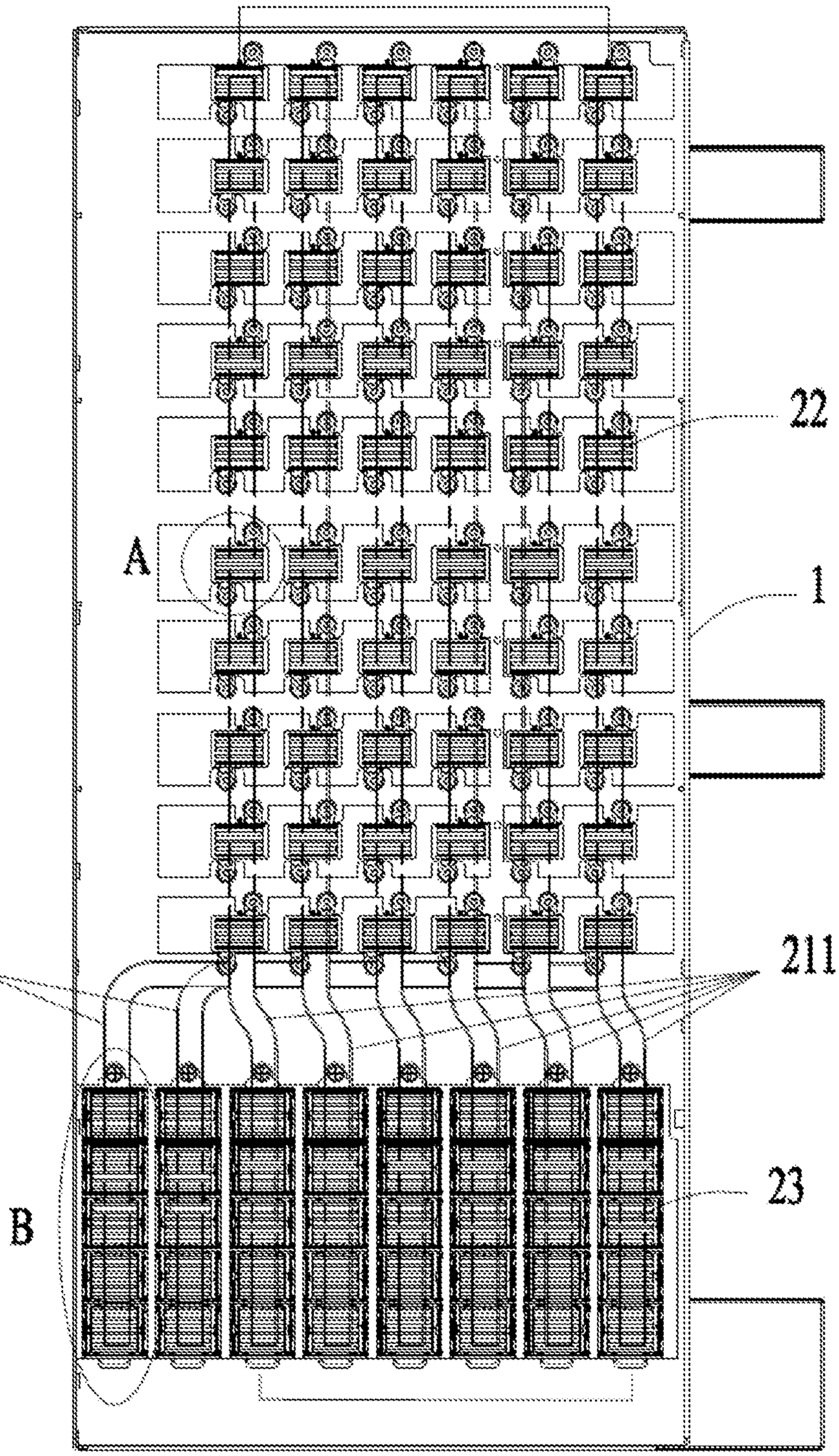

FIG. 2

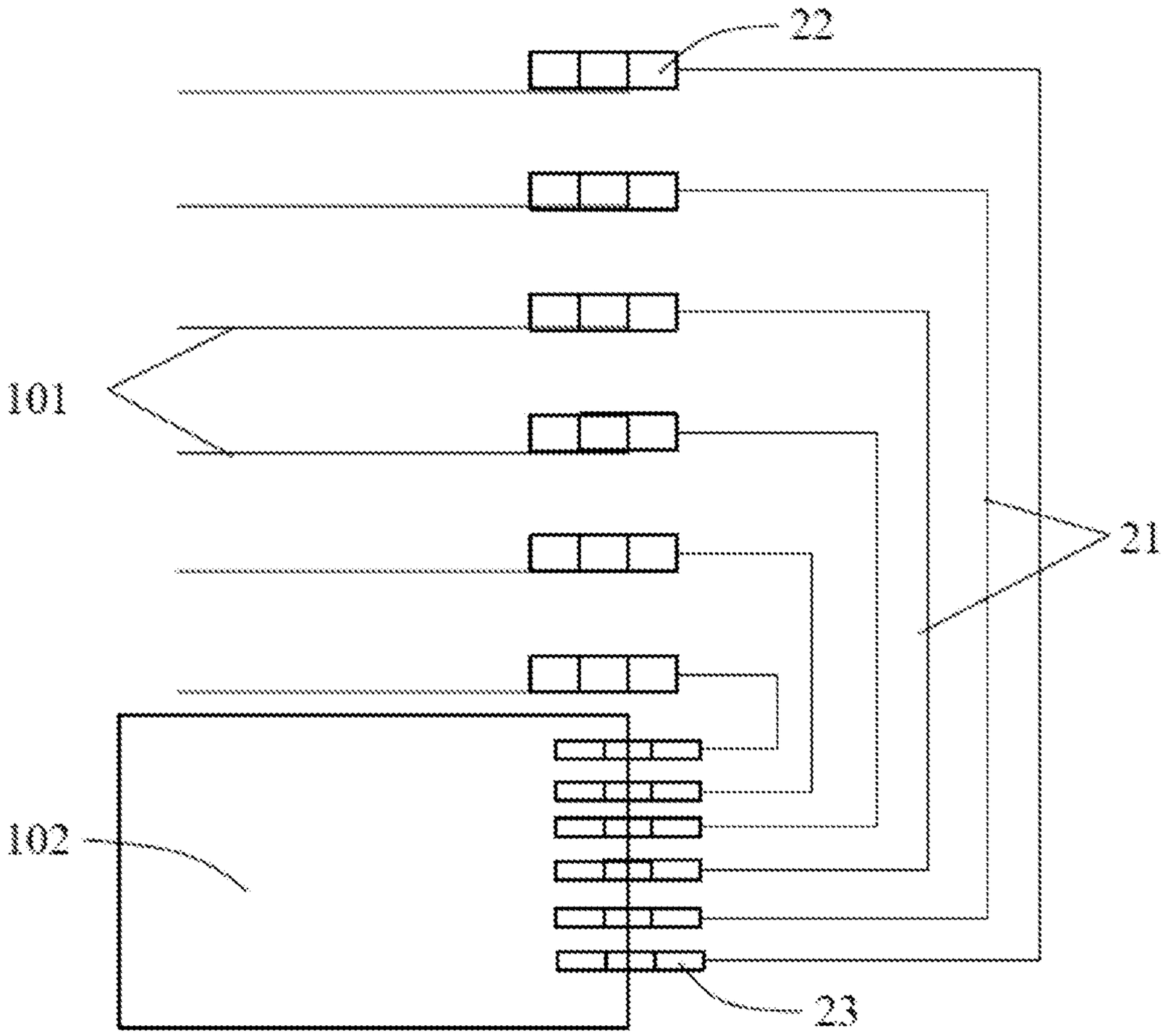

FIG. 3

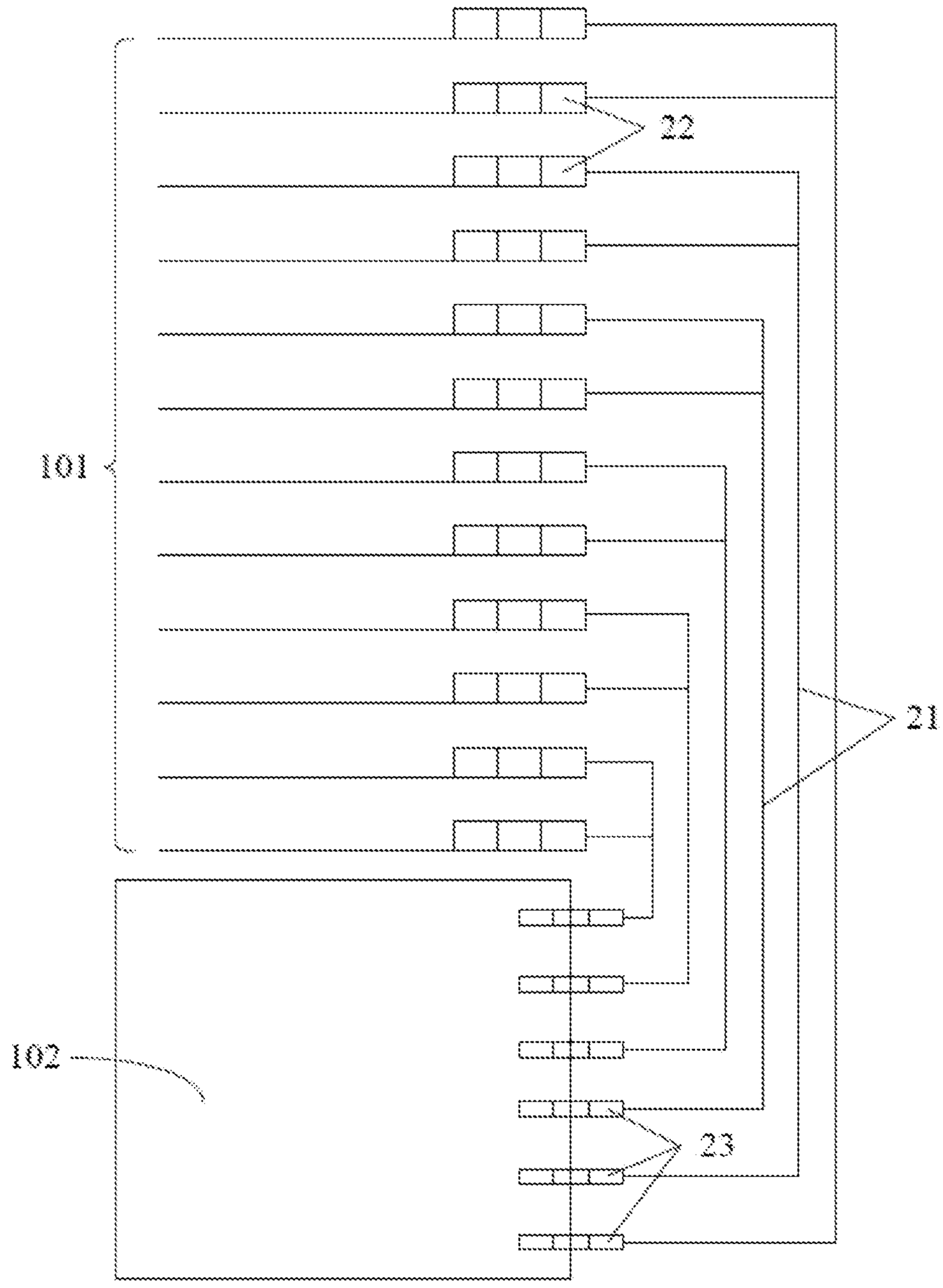

FIG. 4

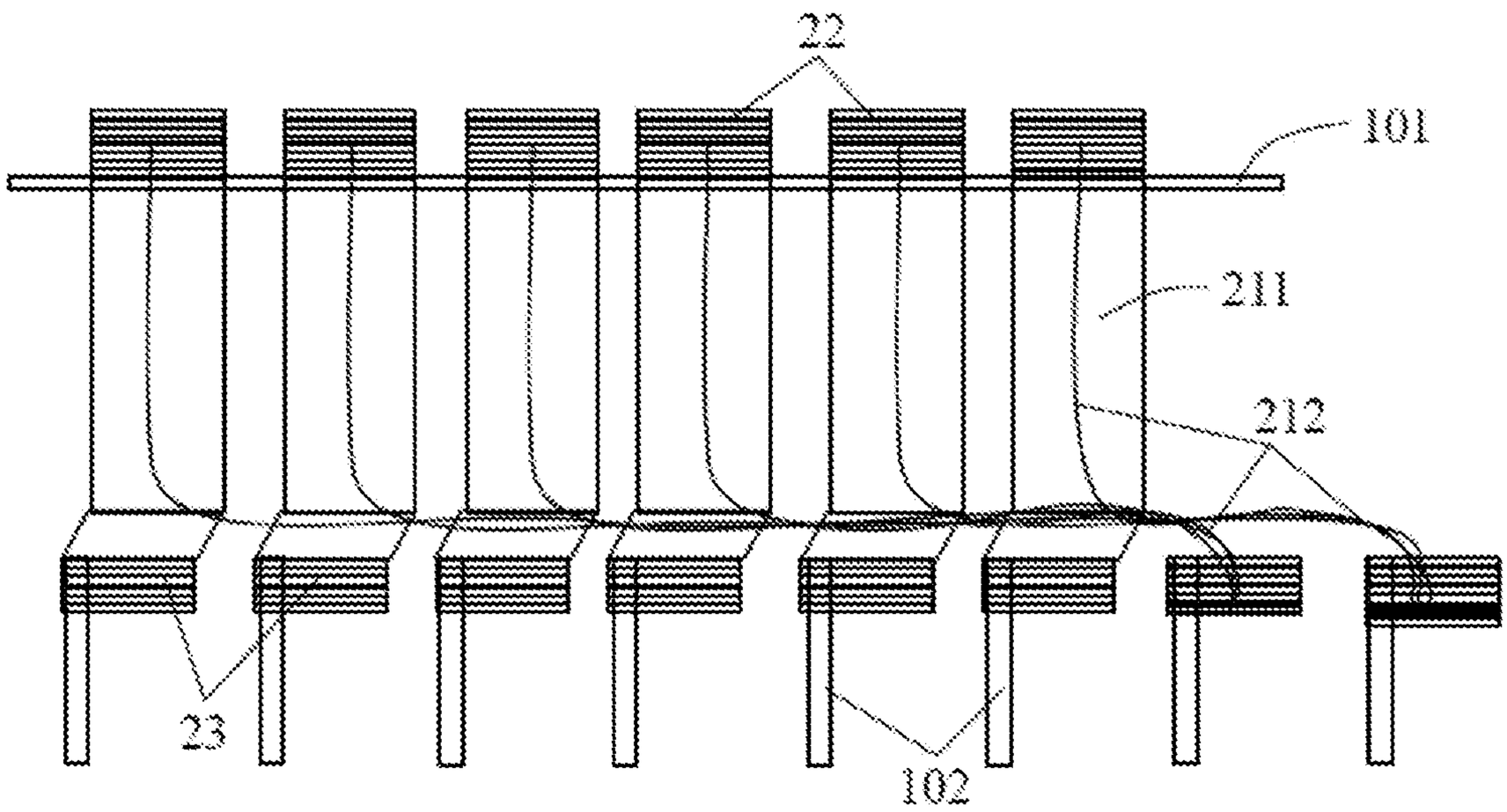

FIG. 5

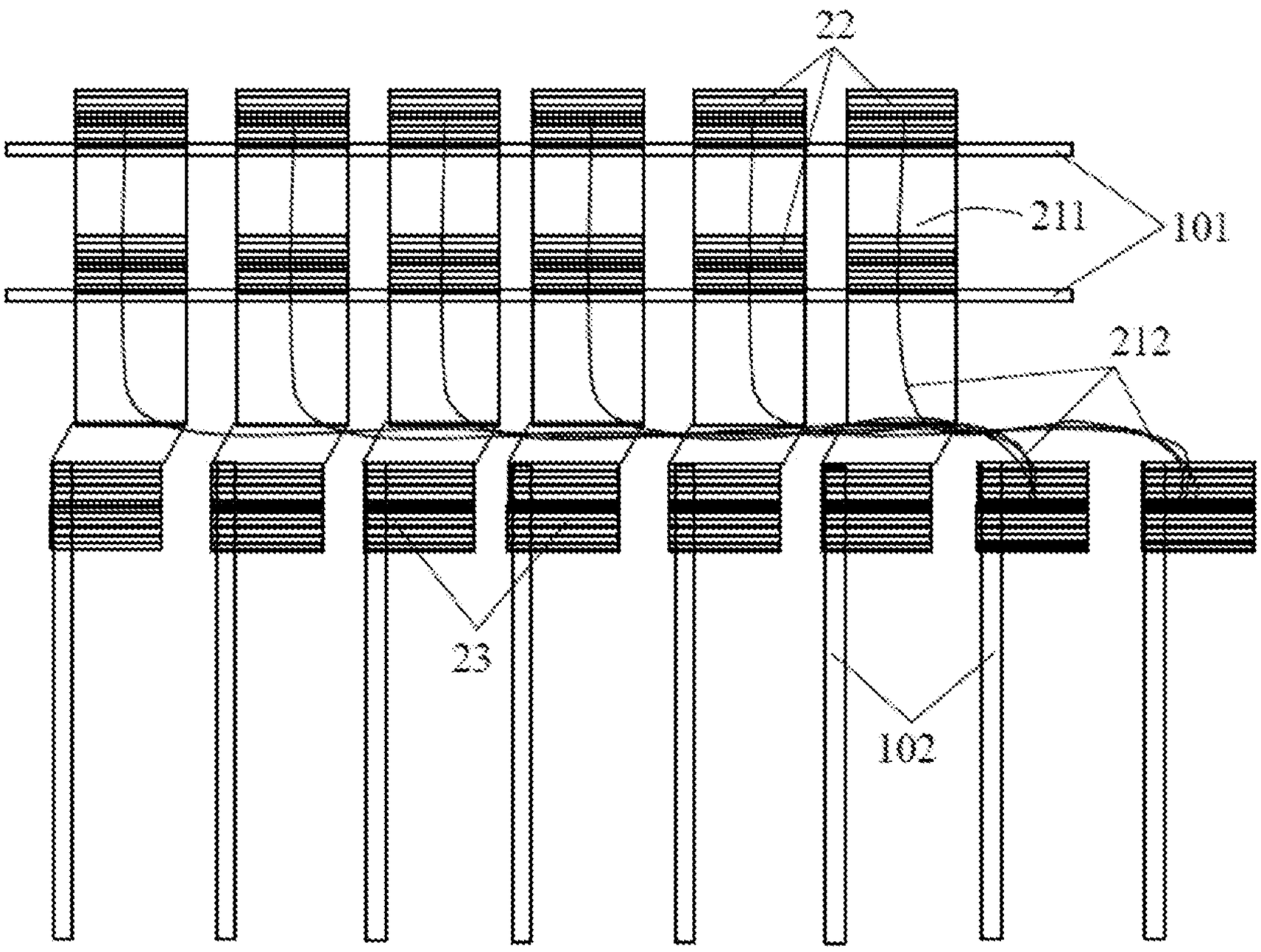

FIG. 6

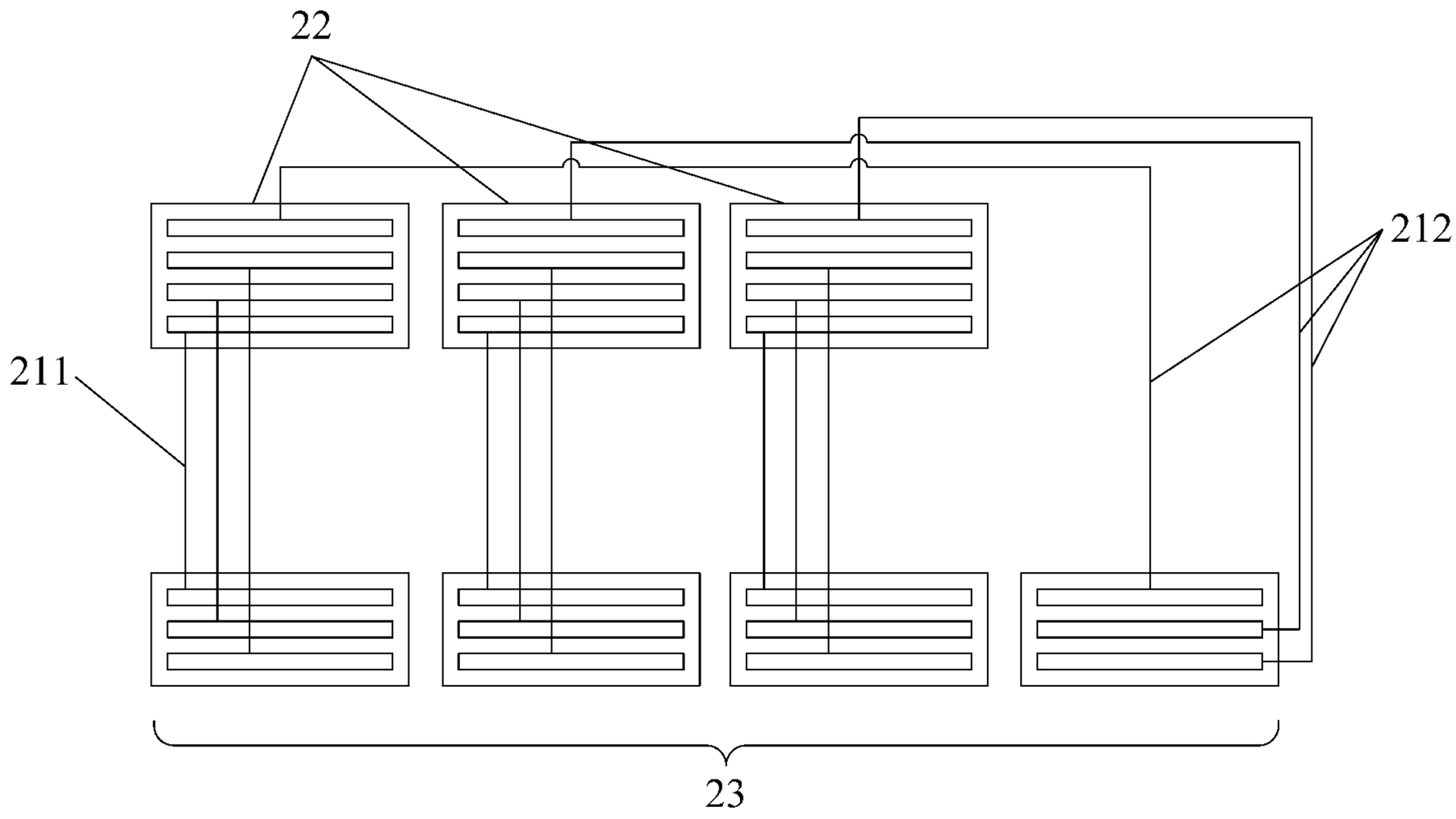

FIG. 7

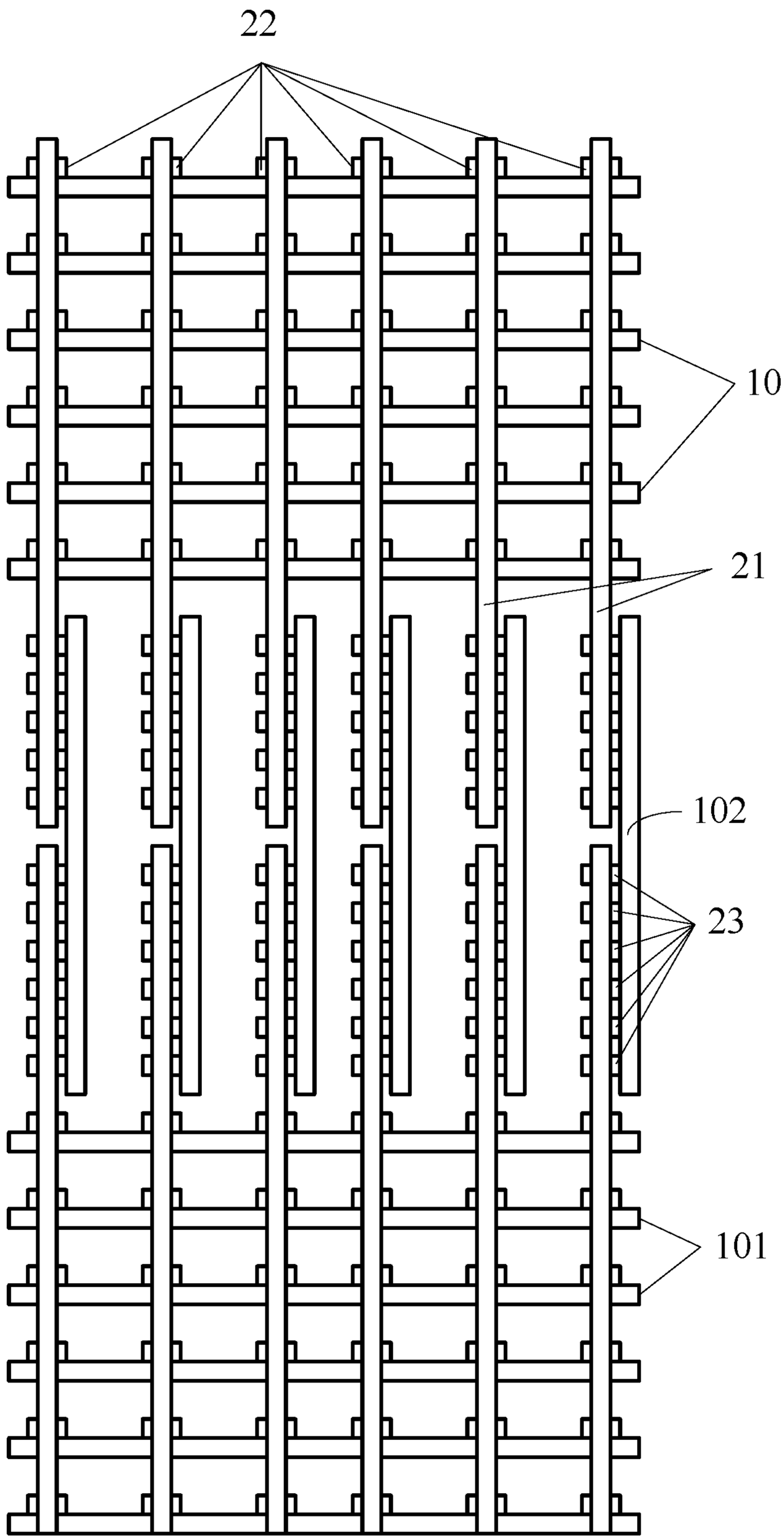

FIG. 8

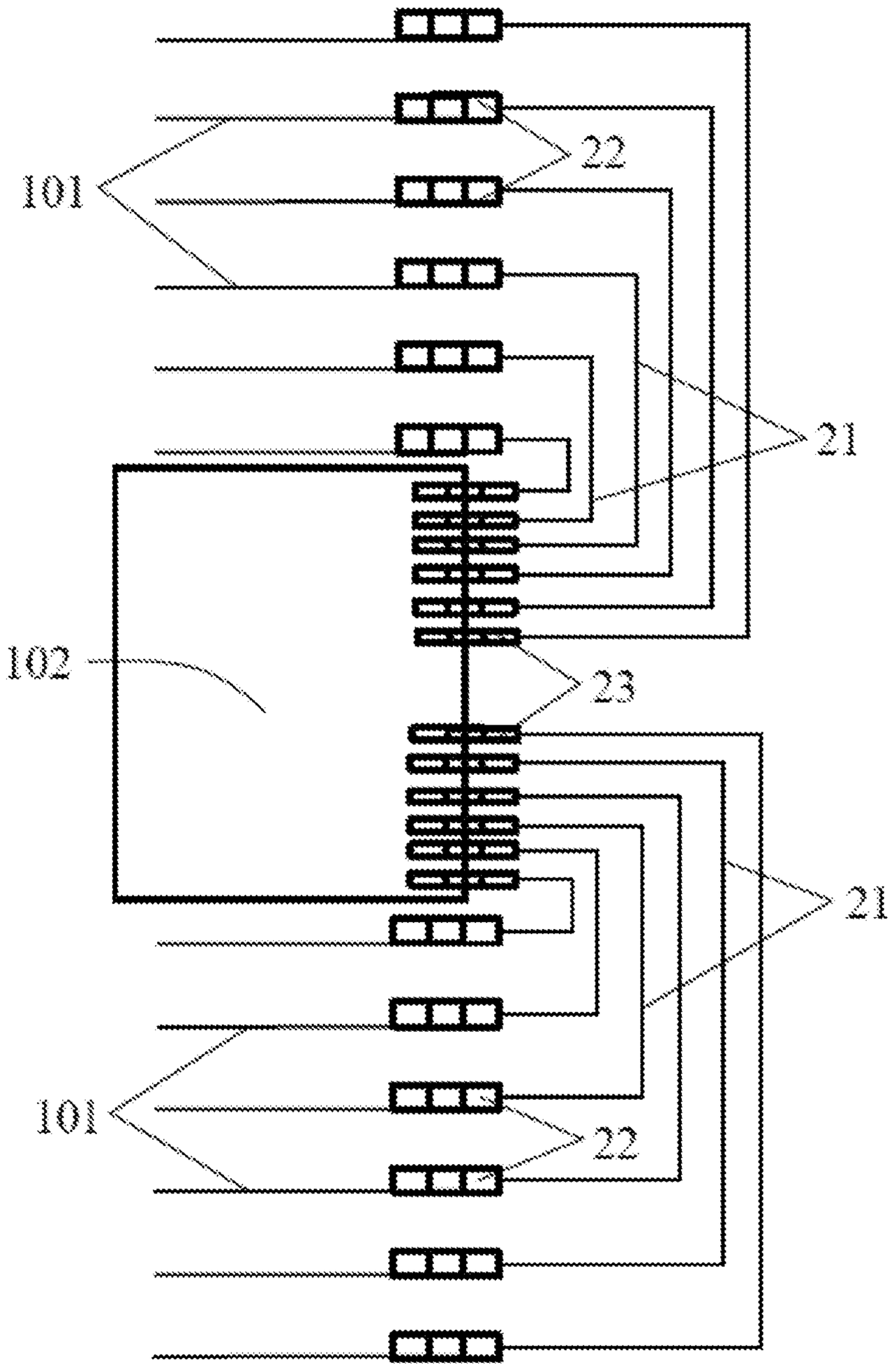

FIG. 9

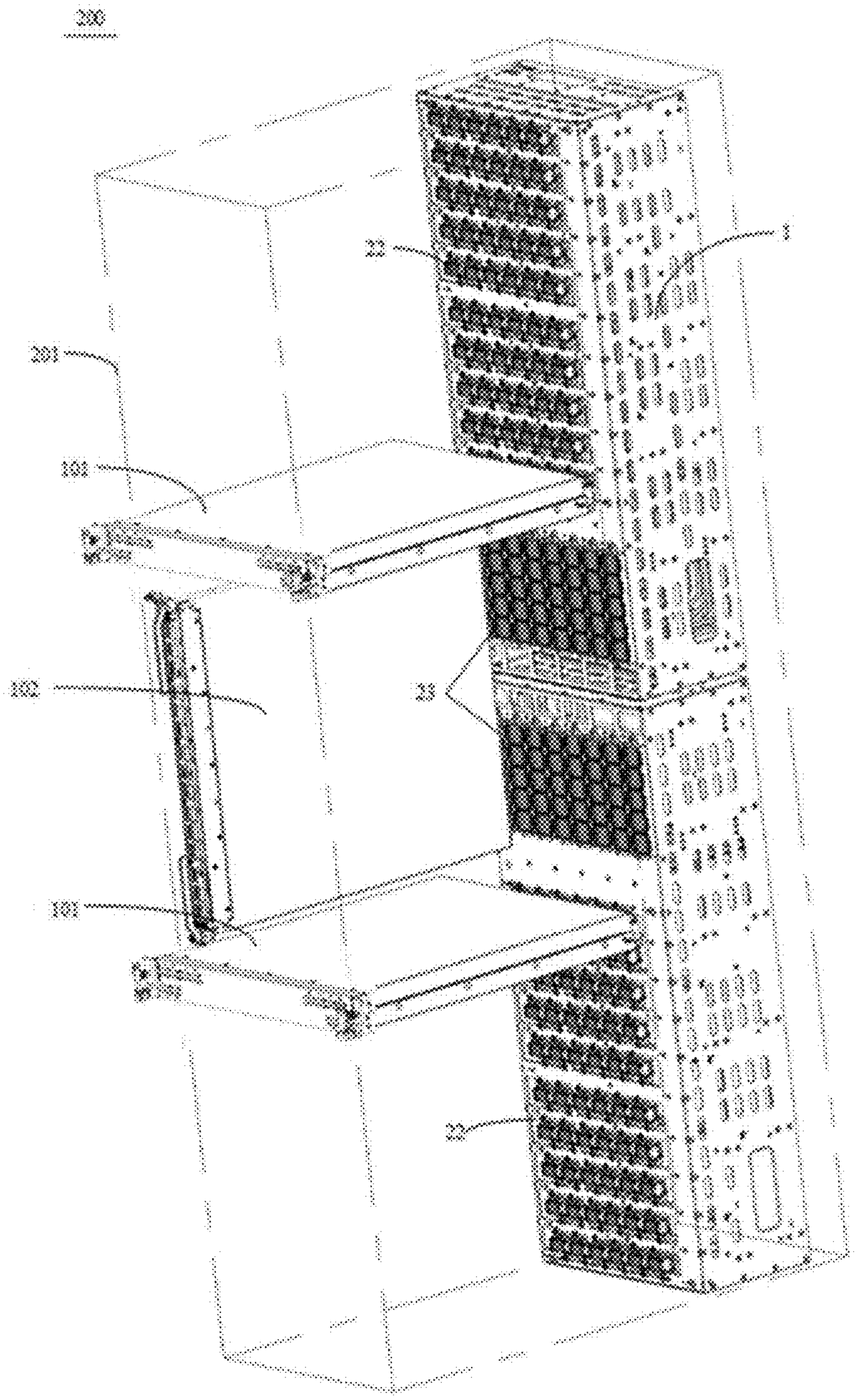

FIG. 10

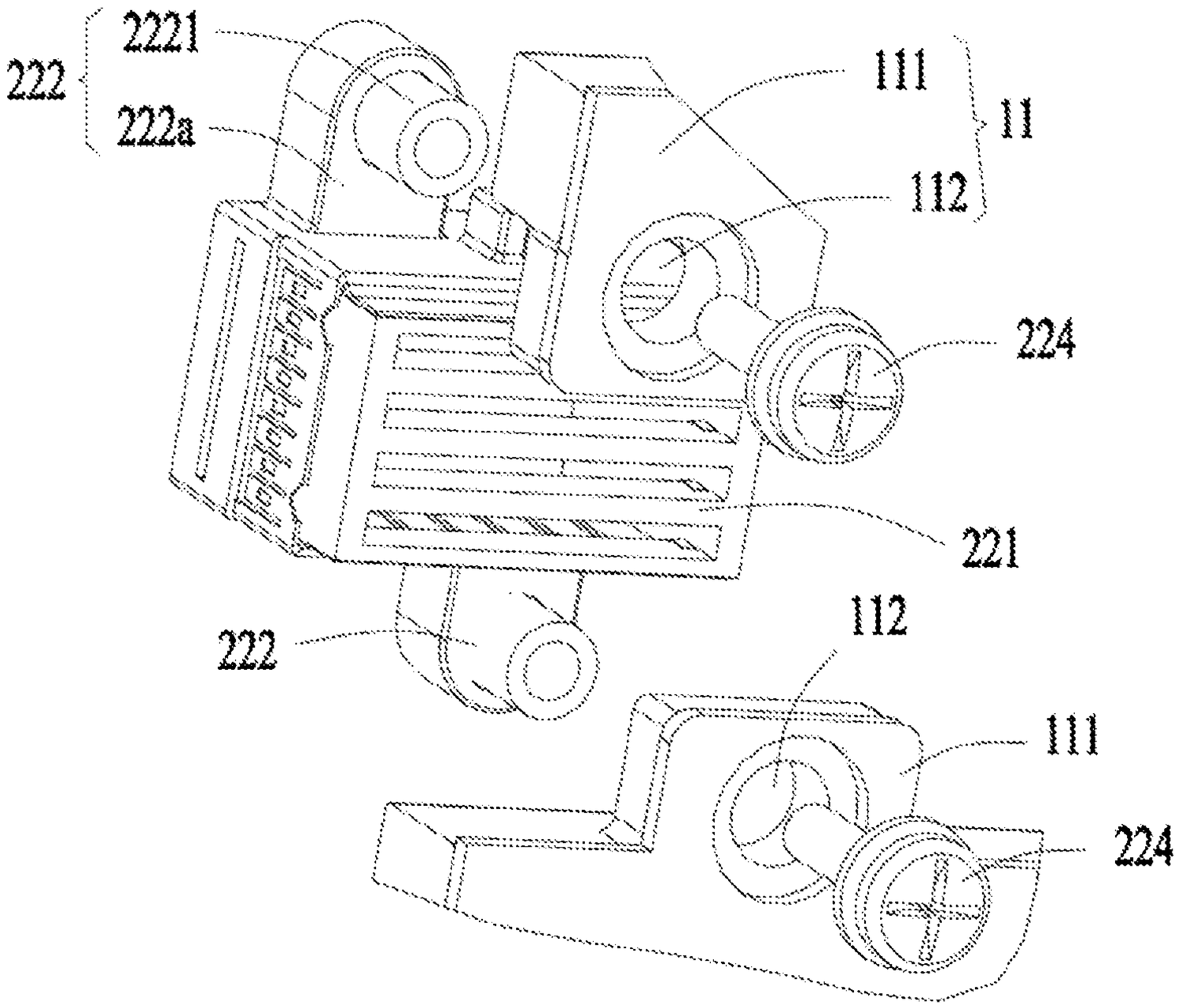
222
2221
222a
111
11
112
224
221
112
222
111
224

FIG. 11

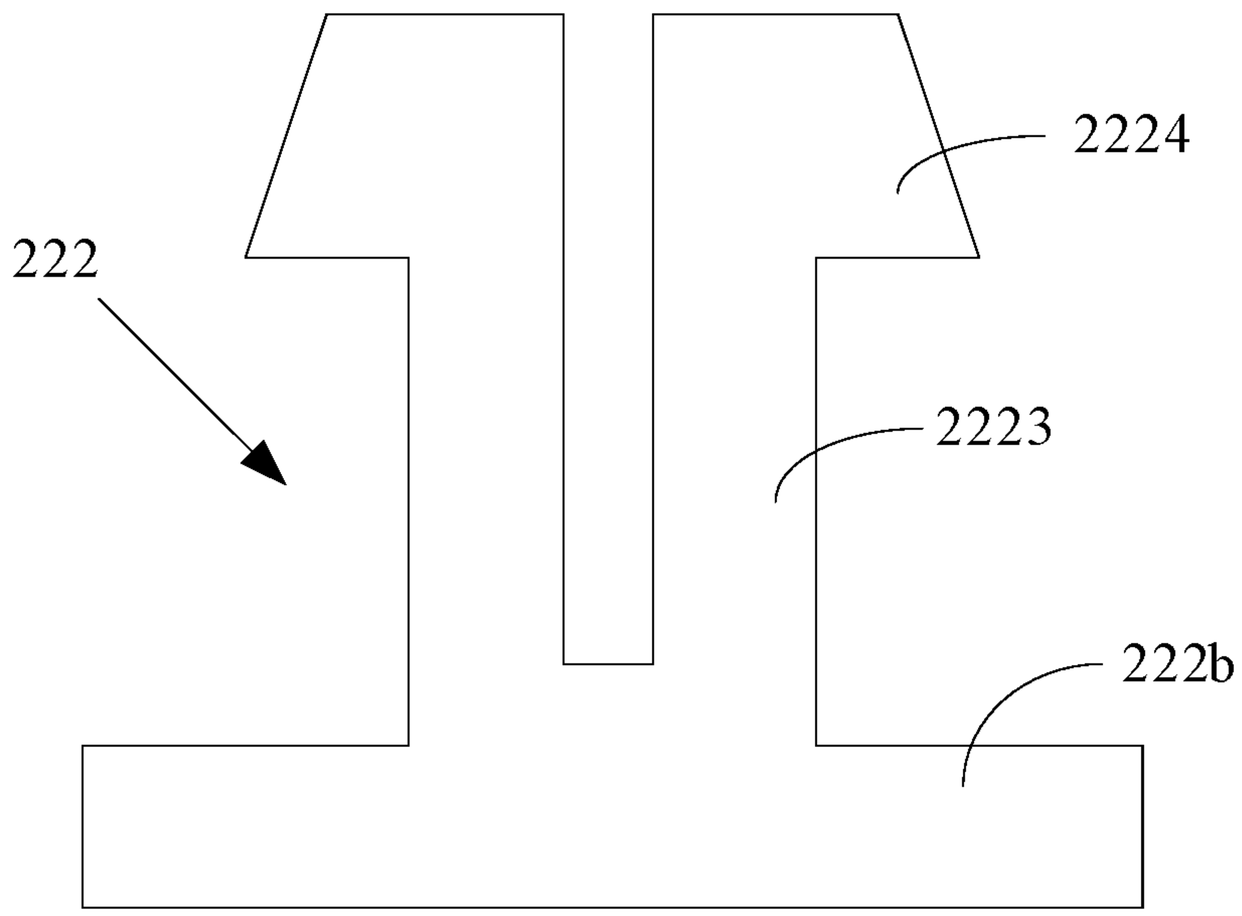
2224
222
2223
222b

FIG. 12

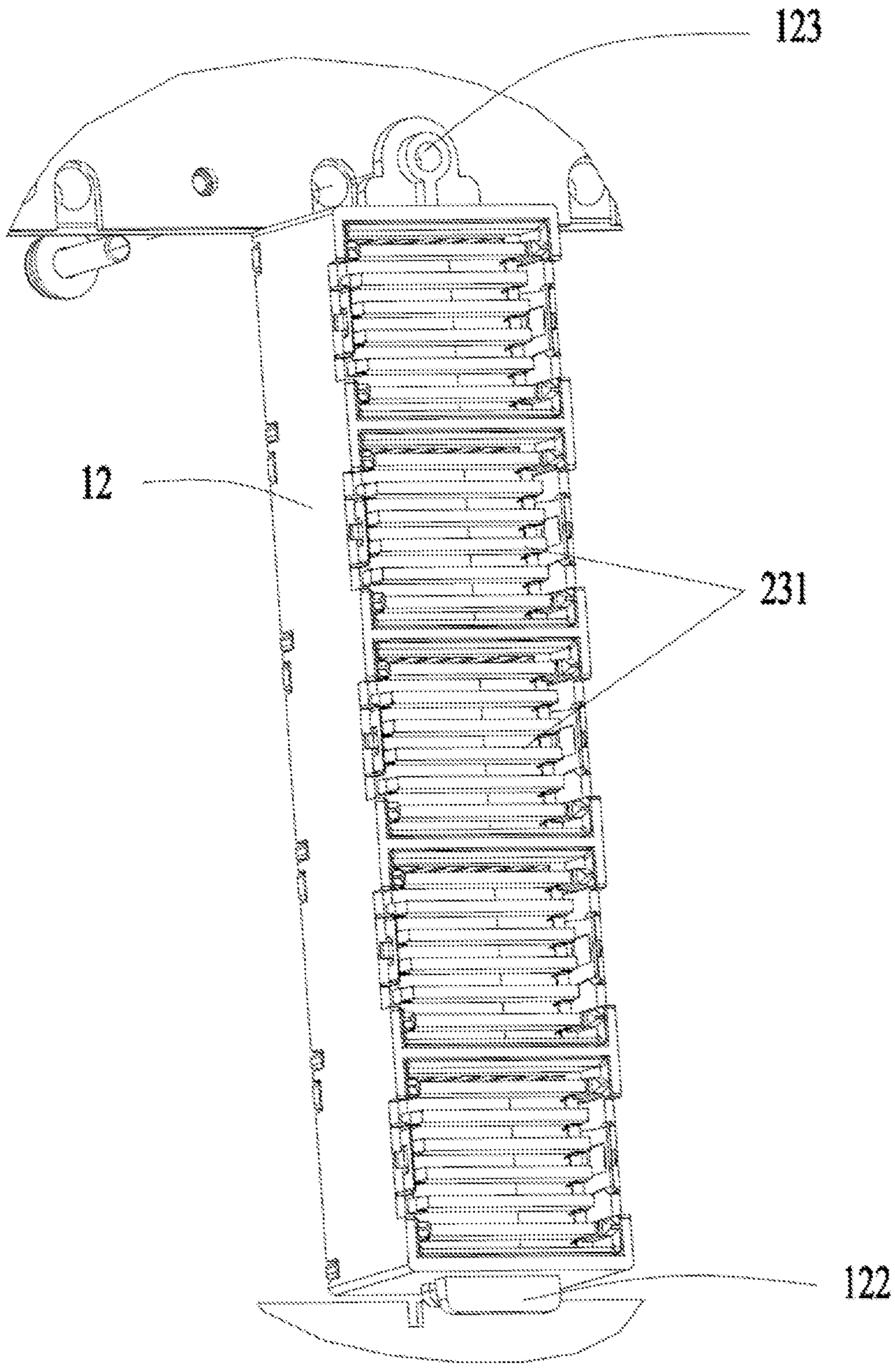

FIG. 13

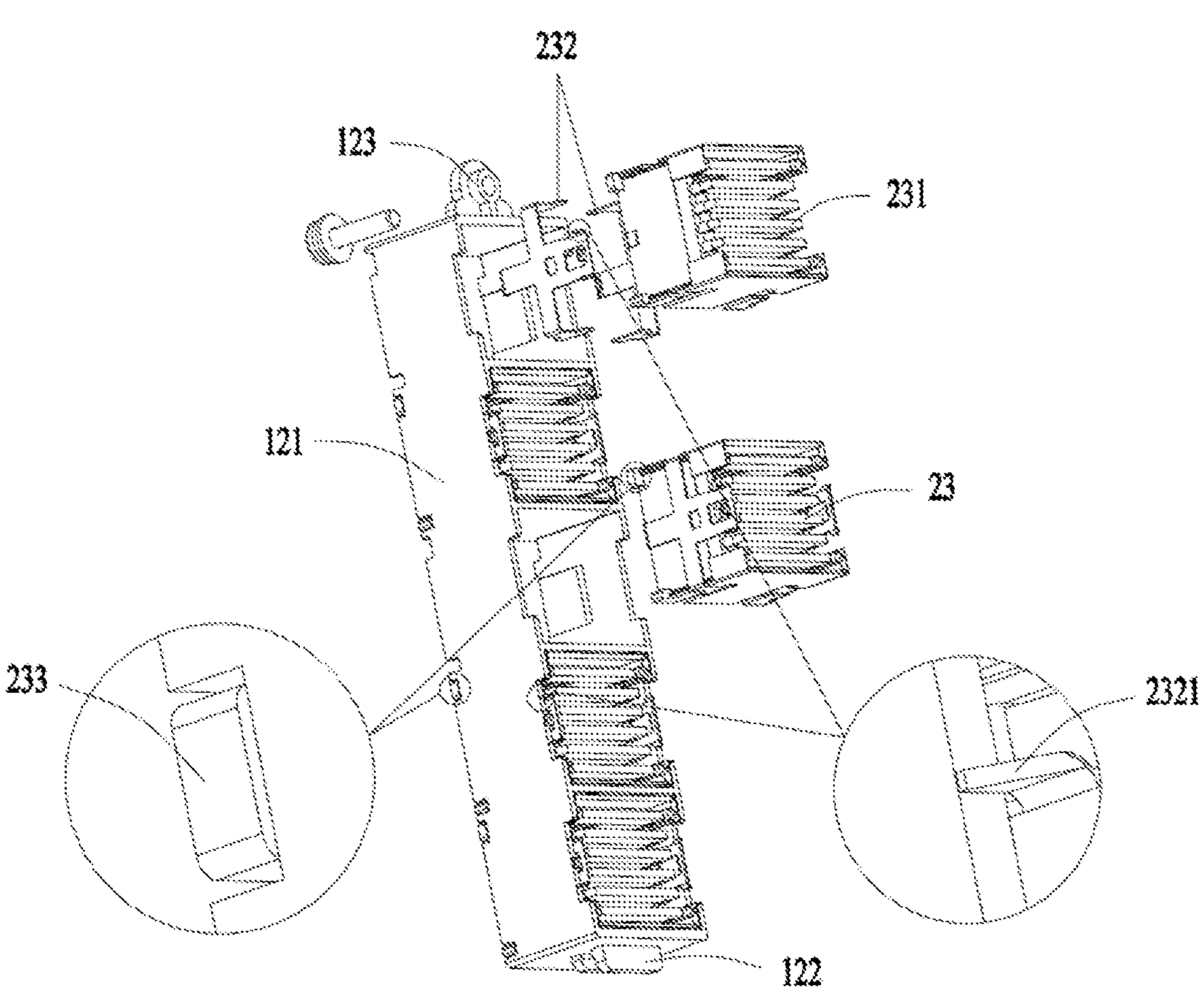

FIG. 14

CABLE BACKPLANE

CROSS REFERENCE TO RELATED APPLICATIONS

This present application is a U.S. National Phase of International Patent Application Serial No. PCT/CN2017/108542 entitled "CABLE BACKBOARD," filed on Oct. 31, 2017. International Patent Application Serial No. PCT/CN2017/108542 claims priority to Chinese Patent Application No. 201610970797.7 filed on Oct. 31, 2016. The entire contents of each of the above-cited applications are hereby amended by reference for all purposes.

BACKGROUND

In communication devices, functions of plug-in cards (single boards) are desired to be clearly partitioned. In particular, plug-in cards with different functions are connected and communicate with each other through connectors to implement a complex communication system.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram illustrating a structure of a cable backplane system according to an example of the present disclosure.

FIG. **2** is a plan view illustrating a cable backplane system according to an example of the present disclosure.

FIG. **3** is a side view illustrating a cable backplane system according to an example of the present disclosure.

FIG. **4** is a side view illustrating a cable backplane system according to an example of the present disclosure.

FIG. **5** is a schematic diagram illustrating that first connectors in a row are connected with second connectors in a row in a cable backplane system shown according to an example of the present disclosure.

FIG. **6** is a schematic diagram illustrating in detail that first connectors in a row are connected with second connectors in a row in a cable backplane system shown according to an example of the present disclosure.

FIG. **7** is a schematic diagram illustrating that first connectors in two rows are connected with second connectors in a row according to an example of the present disclosure.

FIG. **8** is a plan view illustrating a cable backplane system according to an example of the present disclosure.

FIG. **9** is a side view of a cable backplane system illustrated in FIG. **8**.

FIG. **10** is a schematic diagram illustrating a structure of a communication device according to an example of the present disclosure.

FIG. **11** is an enlarged view illustrating a part A in FIG. **2**.

FIG. **12** is a schematic diagram of a structure of a boss according to an example of the present disclosure.

FIG. **13** is an enlarged view illustrating a part B in FIG. **2**.

FIG. **14** is an exploded view illustrating a part B in FIG. **2**.

DETAILED DESCRIPTION OF THE EMBODIMENTS

A clear and complete description of the technical schemes in the examples of the present disclosure is made in conjunction with the accompanying drawings in the examples of the present disclosure. Obviously, the examples as recited herein are merely a part of examples of the present disclosure instead of all examples. All other examples obtained by a person of ordinary skill in the art based on the examples of the present disclosure without creative efforts shall fall within the protection scope of the present disclosure.

In a complex system, various modules (plug-in cards) may be designed according to requirements through a chassis on which a development module is pluggable. The plug-in cards may be connected with each other through a system backplane. As communication traffic of communication products is increasing, the number of the plug-in cards is correspondingly increased. When the system backplane is oversized, it is hard to control dimensions (widths and heights) for chassis of the communication products, which causes difficulties in system design.

FIG. **1** is a schematic diagram illustrating a structure of a cable backplane system according to an example of the present disclosure. FIG. **2** is a plan view illustrating a cable backplane system according to an example of the present disclosure. In the example, the cable backplane system **100** includes a frame **1** and a cable unit **2**. The cable unit **2** is fixed on the frame **1**. The cable unit **2** includes a first connector array, a second connector array and communication cables **21**. The first connector array is fixed on the frame **1**. First connectors **22** in a same row of the first connector array are connected with a first plug-in card. The second connector array is fixed on the frame **1**. Second connectors **23** in a same column of the second connector array are connected with a second plug-in card. The communication cables **21** are connected with the first connector array and the second connector array.

In an example of the present disclosure, the first connector array includes a plurality of first connectors regularly arranged in a transverse direction and a longitudinal direction. Likewise, the second connector array includes a plurality of second connectors regularly arranged in the transverse direction and the longitudinal direction. For example, the first connector array is a combination of 6×6 first connectors, and the second connector array is a combination of 6×6 second connectors. In an example of the present disclosure, each of the first connector array and the second connector array in a figure is a matrix. In another example of the present disclosure, based on space requirements for devices, the first connector array and the second connector array may be arrays with any regular or irregularly shapes.

In an example of the present disclosure, the first connectors **22** and the second connectors **23** are regularly or arbitrarily connected via the communication cables **21**, so that communication between first plug-in cards and second plug-in cards is established based on connections via the communication cables **21**. For example, connectors in the first plug-in card are arranged in a row, when the first plug-in cards are arranged in a transverse direction, each of the connectors on the first plug-in card is connected with a first connector **22** in a same row; connectors in the second plug-in card are arranged in a row, when the second plug-in cards are arranged in a longitudinal direction, each of the connectors on the second plug-in cards is connected with a second connector **23** in a same column. Each of the first plug-in cards is connected with a corresponding second plug-in card via the communication cables **21**.

In an example, the first plug-in cards are service cards, and the second plug-in cards are switch cards, so that it is unnecessary to add switch cards when service cards are added onto the communication device based on service expansion requirements of users, and the communication device can be easily extended. Further, a signal integrity (SI)

performance problem for a high-speed link can be solved by a high-speed feature of the communication cables **21**. In another example, the first plug-in cards are memory cards, and the second plug-in cards are network cards.

In an example in FIG. **3**, the number of columns of the second connector array is equal to the number of columns of the first connector array, and the number of the first connectors **22** in a column is equal to that of the second connectors **23** in the same column, so that the first connectors **22** are connected, one to one, to the second connectors **23** in the same column. In an example, in the first connector array and the second connector array, the first connectors and the second connectors in the same column are respectively connected one to one, which is helpful to determine a connection relation between first connector and second connector and further helpful for administrators to manage and maintain the communication cables.

The communication cables **21** include a plurality of cables. That is, the cables constitute the communication cables **21**. The communication cables **21** are connected with the first connector array and the second connector array, and each of the cables is connected with a first connector and a second connector. In an example, between the first connectors **22** in the same column and the second connectors **23** in the same column, the first connectors **22** are sequentially connected with the second connectors **23** via the cables by taking a first connector and a second connector adjacent to each other as a starting point. For example, there are four rows of the first connectors **22** and four columns of the second connectors **23**. The first connectors **22** in a column are denoted as 1~4 from top to bottom. The second connectors **23** in the same column are denoted as 5~8 from top to bottom. The No. 4 first connector **22** is connected with the No. 5 second connector **23**. The No. 3 first connector **22** is connected with the No. 6 second connector **23**. The No. 2 first connector **22** is connected with the No. 7 second connector **23**. The No. 1 first connector **22** is connected with the No. 8 second connector **23**. In the example, each of the cables is shaped like U as illustrated in FIG. **1**. Thus, the cable unit **2** can be regularly arranged, and the communication cables **21** are provided with heat dissipating channels on a transverse direction and a longitudinal direction, which can avoid that the heat dissipating channels of the communication device are blocked by disorderly-arranged cables, and it is hard to manage communication devices (hard to tease out connection relations of connectors).

In an example, the number of columns of the second connector array is equal to the number of columns of the first connector array. In a column, the number of the first connectors **22** is M times as many as the number of the second connectors **23**, and M first connectors **22** are connected in parallel with a same second connector **23** via the communication cables **21**, where M is a natural number more than 1. In an example, in FIG. **4**, M is equal to 2.

In an example, the number of columns of the second connector array is equal to the number of columns of the first connector array. In a column, the number of the first connectors is different from the number of the second connectors. In this case, one first connector may be connected to a plurality of second connectors, or a plurality of first connectors may be connected to one second connector. In another example, the first connectors may be arbitrarily connected with the second connectors. For example, the first connectors corresponding to a plurality of first plug-in cards constitute a plurality of first connector groups. Each of the first connector groups may include a first connector in first connectors corresponding to each of the first plug-in cards. A plurality of first connectors in a same row in different first connector groups are different from each other. The first connectors in the first connector groups are connected, one to one, with the second connectors in same columns.

In another example of the present disclosure in FIGS. **2** and **5**, the number of columns of the second connector array is more than the number of columns of the first connector array. The second connector array includes base columns and extension columns, where the number of the base columns is equal to the number of the columns of the first connector array. Second connectors **23** on at least one extra column are connected with extended second plug-in cards **102** such that data processing can be accelerated, data processing capacity can be improved, and data exchange pressure can be alleviated for the second plug-in cards **102**. In the example, the number of the second plug-in cards **102** may be increased or decreased according to the number of the desired first plug-in cards **101** such that system flexibility can be improved, and resource waste can be reduced.

In an example, FIG. **6** is a profile chart illustrating a row of first connectors **22** and a row of second connectors **23**. In FIG. **6**, the number of the first connectors **22** is less than the number of the second connectors **23**, and three first connectors **22** corresponds to four second connectors **23**, which are taken as an example for description herein. The number of signal pins on a first connector **22** is more than the number of signal pins on a second connector **23**. A part of the signal pins on the first connectors **22** are connected, one to one, with the signal pins on the second connectors **23** via signal lines in cables. Extra signal pins on each of the first connectors **22** in the row are connected with signal pins on the second connectors **22** in the extension columns via signal lines in the cables. Thus, signal can be completely sent between the first connectors **22** and the second connectors **23**, and difficulty degree of completing the cable unit can be reduced. It is not limited in the present disclosure that the three first connectors **22** correspond to four second connectors **23**. According to design requirements, the number of first connectors **22** and the number of second connectors **23** may be any values when it is satisfied that the signal pins on the first connectors **22** and the signal pins on the second connectors **23** are fit for connection with each other, and signals can intercommunicate with each other. In the case above, the number of the first connectors **22** may more than the number of the second connectors **23**.

There may be some problem for the switch cards, e.g., the switch cards is overlarge in size, the switch cards is hard to be processed, the high-speed link of the switch cards is long, and it is hard for wiring on the switch cards. In an example of the present disclosure, the extension columns for the second connectors are added to reduce design difficulty of the switch cards (the second plug-in cards). For example, the number of the switch cards is equal to the number of the service cards, and eight chips are placed on each of the service cards. 48 chips in total are desired when six switch cards are designed. However, when the number of the switch cards is more than the number of the service cards (for example, eight switch cards), six chips are arranged on each of the switch cards to reach 48 chips in a way that the number of the chips on the switch cards is reduced, and it is easy to design the switch cards.

When the number of columns of the second connector array is more than the number of columns of the first connector array, the second connector array may be divided into base columns and extension columns. In the second connector array, the base columns include columns the number of which is same as the number of the columns of

the first column array, the extension columns includes additional columns in the second connector array. In FIG. **2**, there are six columns of the first connectors in the first connector array, and there are eight columns of the second connectors in the second connector array, where there are six base columns and two extension columns in the second connector array. It is not limited in examples of the present disclosure which columns are the base columns and which columns are the extension columns in the second connector array. In the example, the communication cables **21** are divided into a first cable group **211** and a second cable group **212**, where each of the first cable group and the second cable group includes a plurality of cables. when the first connectors **22** in a row are respectively connected with the second connectors **23** in another row (i.e., a first plug-in card **101** is connected with each of second plug-in cards **102**), the first connectors **22** are connected with the second connectors **23** in the base columns via the cables in the first cable group **211** and connected with the second connectors **23** in the extension columns via the cables in the second cable group **212**. When the second connector **23** in a row does not correspond to any of the first connectors **22** in the row, the column including the second connector is the extension column. In the example, a first connector **22** is connected with an extended second connector **23** via a signal line in the communication cables **21** via which the first connectors **22** are connected with the second connectors **23**, so as to increase the number of the second plug-in cards **102**. According to the layout above for the communication cables **21**, connections between connectors can be ensured to satisfy data interaction requirements, connection relations of connectors is clear, and heat dissipating channels are formed among cables in a same column.

In FIGS. **2** and **7**, to ensure that a communication device is configured with more first plug-in cards **101**, first connectors **22** in at least two rows are connected in parallel with second connectors **23** in another row via the communication cables **21**. In the example, when a plurality of first connectors are connected with a second connector, the number of the signal pin cables on the second connector is more than the number of the signal pins on the first connector, and a volume of the second connector is larger than a volume of the first connector in a way that signal transmission stability can be improved. In an example, different cables in the communication cables **21** are shaped like U in a way that there is no cross with each other. In the case above, the communication cables **21** are provided with the heat dissipating channels in the transverse direction and the longitudinal direction.

A spacing between two adjacent columns of the first connectors is larger than a spacing between two adjacent columns of the second connectors. The cables in the first cable group **211** are bent to be connected with the first connector array and the base columns in the second connector array. The cables in the second cable group **212** are bent to be connected with the first connector array and the extension columns in second connector array. In an example, the cables in the first cable group **211** are bent with a same first bending angle when the first connectors **22** connected with the cables in the first cable group **211** are in a same column, the second cable group **212** are bent with a same second bending angle when the second connectors **23** connected with the second cable group **212** are in a same column, so that the cables are regularly placed to facilitate management for the cables.

In another example, the first connectors **22** are connected with the second connectors **23** in any manner when it is satisfied that a first plug-in card is connected with each of second plug-in cards for communication, and a second plug-in card is connected with each of first plug-in cards for communication.

In FIGS. **8-10**, in another example of the present disclosure, the cable backplane system **100** includes two first connector arrays. A second connector array is located between the two first connector arrays and connected with the two first connector arrays via the communication cables **21** respectively. The second connector array is further divided into two parts. The two parts of the second connector array are respectively connected with the two first connector arrays via the communication cables **21**. For example, in FIG. **8**, a first connector array **101_1** includes six rows, and another first connector array **101_2** also includes six rows. Each column of the second connector array between the first connector array **101_1** and **101_2** includes twelve second connectors **23**. Six second connectors **23** in top of the column are connected, one to one, with the first connectors **22** in the first connector array **101_1** in the same column. Six second connectors **23** in bottom of the column are connected, one to one, with the first connectors **22** in the first connector array **101_2** in the same column.

In an example in FIGS. **10** and **11**, the frame **1** includes a first component **11** to be cooperatively connected with a first connector. The cable unit is cooperatively connected with the first component **11** via the first connector **22** in a way that the cable unit is fixed on the frame **1**. In the example, the first component **11** may be integrally-molded with a main body of the structural frame, or may be fixed on the main body of the frame via bolts or rivets.

The first component **11** includes a main body of the first component **111** and a connecting hole **112** on the main body of the first component **111**, where the connecting hole **112** is used to be connected with the first connector **22**. In another example, the connecting hole **112** is another structure cooperatively connected with the first connector **22**, for example, a connecting part or a clamping structure, etc.

The first connector **22** includes a main body of the first component **221** and a convex platform **222** which respectively extends from upside and downside of the main body of the first connector **221**. The convex platform **222** cooperates with the connecting hole **112** in a way that the first connector **22** is connected with the first component **11**. In an example, the convex platform **222** is fixed in the connecting hole **112**.

In an example in FIGS. **10** and **11**, the convex platform **222** includes a substrate **222***a*, and a stud **2221** arranged on the substrate **222***a*. The first component **11** further includes a screw **224** cooperating with the connecting hole **112** in a way that the screw **224** is cooperatively connected with the stud **2221**. The stud **2221** is fixed with the screw **224** directly by passing through the connecting hole **112** on the first component **11** in a way that the first component **11** is clamped by the screw **224** and the convex platform **222** of the first connector **22** to be connected with the first connector **22**.

A height of the stud **2221** is larger than a depth of the connecting hole **112**. That is, the height of the stud **2221** is larger than a material thickness of the first component **11** in a way that the first connector **22** can move in a direction opposite to the first component **11**, i.e., a floating quantity is designed for the first connector **22** to absorb structural tolerance. In an example, the floating quantity of the first connector **22** in the direction opposite to the first component **11** is adjusted by changing the material thickness of the first component **11**.

Further, an external diameter of the stud **2221** is smaller than a diameter of the connecting hole **112** in a way that gap cooperation is implemented through a difference value between the diameter of the connecting hole **112** and an axis diameter of the stud **2221**, and the first connector **22** can provide the floating quantity for the stud **2221** in a radial direction. In an example, when design for the floating quantity of the first connector **22** is determined to be unreasonable, the diameter of the connecting hole **112** on the first component **11** is directly changed to adjust the floating quantity, rather than that the first connector **22** is changed, which can make implementation easer compared with changing the first connector **22**.

In another example in FIG. **12**, the convex platform **222** includes a substrate **222***b*, a protrusion **2223** arranged on the substrate **222***b*, and a limiting part **2224** arranged at a free end of the protrusion **2223**, where the protrusion **2223** is arranged to be hollow. An external diameter of the protrusion **2223** is smaller than the diameter of the connecting hole. An external diameter of the limiting part **2224** is larger than the diameter of the connecting hole. In the example, the protrusion **2223** is arranged to be hollow in a way that the protrusion **2223** has elasticity. When the protrusion **2223** is assembled to the first component **11**, the free end of the protrusion **2223** is compressed by an external force to make the limiting part **2224** limited until the limiting part **2224** passes through the connecting hole **112**. The external force is removed when the limiting part **2224** passes through the connecting hole **112**. The limiting part **2224** recovers to an original state based on an elastic force in a way that the first component is limited between the limiting part **2224** and the substrate **222***b*, and assembly for the first connector **22** and the first component **11** is completed.

In the example, the limiting part **2224** may be an inverse ratchet in a way that a circumferential side of the limiting part **2224** has a guidance inclined plane, and the first connector can easily be plugged into the first component **11** to make assembly easy. The external diameter of the protrusion **2223** is smaller than the diameter of the connecting hole in a way that gap cooperation is implemented through a difference value between the diameter of the connecting hole **112** and an external diameter of the protrusion **2223**, and the first connector **22** can provide floating quantity for the protrusion **2223** in a radial direction. Further, a floating quantity is designed for the first connector **22** in an axis direction to absorb structural tolerance.

In FIGS. **2**, **13** and **14**, the frame **1** further includes a second component **12** cooperatively connected with second connectors **23**. The cable unit is cooperatively connected with the second component **12** through the second connector **23** in a way that the cable unit is fixed on the frame **1**. The second component **12** includes a metal housing **121**, a clamping part **122** arranged at a side of the metal housing **121**, and a connecting part **123** arranged at another side of the metal housing **121**, where the connecting part **123** and the clamping part **122** are respectively located at two opposite sides of the metal housing **121**. The second connector **23** is fixed on the main body of the frame through the metal housing **121**. In an example, the second component **12** is cooperatively clamped with the main body of the frame **1** through the clamping part **122**, and is fixed on the main body of the frame **1** through the connecting part **123**. Thus, assembly space for the second connector **23** on the frame **1** can be saved, and a plurality of second connectors **23** can be assembled through a connecting part **123** and a clamping part **122**. In an example, a bolt is used as the connecting part **123**.

A plurality of second connectors **23** are assembled in accommodation space of the metal housing **121**. The second connectors **23** fixed into the metal housing **121** are cooperatively plugged into the same second component. The second connector **23** includes a main body of the second connector **231**, an elastic slice **232** cooperatively clamped on the main body of the second connector **231**, and a protrusion part **233** arranged at a bottom of the main body of the second connector **231**. A gap is provided between the main body of the second connector **231** and the accommodation space. The main body of the second connector **231** is cooperatively clamped in the gap through the elastic slice **232** in a way that the main body of the second connector **231** is fixed on the metal housing **121**. The main body of the second connector **231** has a floating quantity relative to the metal housing **121** based on elastic attributes of the elastic slice **232**.

Further, the elastic slice **232** includes a limiting part **2321** bending outward and extending out. When the second connector **23** is mounted in the accommodation space of the metal housing **121**, the protrusion part **233** is cooperated with a slot in the metal housing **121**, and limiting part **2321** presses against an upper-end surface of the metal housing **121**. Based on the a feature of the protrusion part **233** and a feature of the limiting part **2321**, the second connector **23** can provide location limit between the main body of second connector **231** and the metal housing **121** in an assembly direction, further there is a floating quantity in the assembly direction.

In the example, the main body of the second connector includes a shell enclosed to be a frame structure and a plurality of elastic slide pins arranged in the shell. In an example, the elastic piece pins are arranged in parallel. When a plurality of the first connectors are connected with a second connector, the number of the elastic piece pins on the first connector is smaller than the number of the elastic piece pins on the second connector, and a volume of the second connector is larger than a volume of the first connector.

In examples of the present disclosure, a cable backplane system **100** is designed such that backplane design complexity can be simplified, and increased communication traffic can be satisfied. Further, a SI performance problem for a high-speed link in the cable backplane system **100** can be solved by a high-speed feature of the communication cables **21**. By using the cable backplane system **100**, dimension of the backplane system can be reduced, the first plug-in cards can extend.

According to examples of the present disclosure, a communication device **200** is provided. In an example in FIG. **10**, the communication device includes a device chassis **201**, a cable backplane system as described above, a plurality of first plug-in cards **101** and a plurality of second plug-in cards **102**. A first plug-in card **101** is connected with first connectors in a same row on the cable backplane system. A second plug-in card is connected with second connectors in a same column on the cable backplane system.

In the cable backplane system **100**, the frame **1** may be fixed on the device chassis **201** in a way that the whole cable backplane system **100** is fixed on the device chassis **201**. Alternatively, the frame **1** may be a part of the device chassis **201**, which is integrally-molded with the device chassis **201**.

In an example, connectors on the first plug-in card **101** are arranged in a row, and connectors on the second plug-in card **102** are arranged in a row. When the first plug-in card **101** and the second plug-in card **102** are respectively connected with the first connector array and the second connector array, the connectors on the first plug-in card **101** are cooperatively

plugged into first connectors **22** in a row of the first connector array, and the connectors on the second plug-in card **102** are cooperatively plugged into second connectors **23** in a column of the second connector array. In an example of the present disclosure, the first plug-in card **101** is a service card, the second plug-in card **102** is a switch card, and a plurality of service cards may communicate with each other via a plurality of switch cards.

In an example in FIGS. **8-10**, based on layout of the first connector array and the second connector array in the cable backplane system **100**, a plurality of first plug-in cards **101** are divided into two groups, second plug-in cards **102** are located between the two groups of first plug-in cards **101**. The second plug-in cards **102** are respectively connected with the two groups of the first plug-in cards **101** via the cable backplane system **100**. In the example, the second plug-in cards **102** in the communication device are separately connected with the two groups of the first plug-in cards **101**. The two groups of the first plug-in cards **101** can perform information interaction with each other via the second plug-in cards **102**. The second plug-in cards **102** are in the middle in a way that lengths of cables in the cable unit **2** can be shorten.

In an example in FIGS. **2-7**, the first plug-in cards **101** are located above the second plug-in cards **102**. The number of the first plug-in cards **101** is N times as many as the number of the connectors on the second plug-in cards **102**, and the connectors on N first plug-in cards **101** in a same column are connected with the connectors on a corresponding second plug-in card **102** via the cable unit **2** in the cable backplane system **100**, wherein N is a natural number greater than 1. Thus, dimension of the communication device can be significantly reduced, and more first plug-in cards **101** can be configured, thereby improving service processing capacity for the communication device.

Further, the communication device may increase the second plug-in cards **102** by increasing columns of the second connector array in a way that the service processing capacity of the communication device can be improved, service processing speed can be increased, and it can be satisfied that the communication device is configure with more first plug-in cards **101**.

Cable backplane systems and communication devices are provided according to examples of the present disclosure. High-speed cables can be used to be connected with service cards and switch cards in a way that data interaction speed can be improved. Based on the layout of the cable unit, flexible configuration for the cable backplane system can be implemented, and a plurality of configuration requirement for the service cards and the switch cards can be satisfied. Further, the communication device provided with the cable backplane system has strong service processing capacity and enhanced extendibility in a way that configuration requirements of users for the service cards and the switch cards can be satisfied, and market competitiveness can be improved.

Apparatus examples are basically corresponding to the method examples, and thus method examples can serve as reference. Apparatus examples set forth above are merely exemplary, wherein units described as detached parts can be or not be detachable physically; parts displayed as units can be or not be physical units, i.e., either located at the same place, or distributed on a plurality of network units. Modules may be selected in part or in whole according to actual needs to achieve objectives of the solution of this example. Those of ordinary skill in the art may comprehend and implement the example without contributing creative effort.

It is to be noted that a relational term (such as a first or a second . . .) herein is merely intended to separate one entity or operation from another entity or operation instead of requiring or hinting any practical relation or sequence exists among these entities or operations. Furthermore, terms such as "comprise", "include" or other variants thereof are intended to cover a non-exclusive "comprise" so that a process, a method, a merchandise or a device comprising a series of elements not only includes these elements, but also includes other elements not listed explicitly, or also includes inherent elements of the process, the method, the merchandise or the device. In the case of no more restrictions, elements restricted by a sentence "may include a . . . " do not exclude the fact that additional identical elements may exist in a process, a method, a merchandise or a device of these elements.

The above describes in detail the method and the apparatus provided by the examples of the present disclosure, elaboration of principles and implementations of the present disclosure is made by using specific examples herein, and the description of the foregoing examples is merely intended to assist in understanding the method of the present disclosure and the core concept thereof; also, those of ordinary skill in the art may change, in according with the concept of the present disclosure, a concrete implementation and a scope of application. In conclusion, contents of the specification shall be not interpreted as limiting the present disclosure.

The invention claimed is:

1. A cable backplane system, comprising:

a frame; and a cable unit, comprising:

a first connector array, fixed on the frame, wherein a first connector in the first connector array is connected with a first plug-in card, and first connectors in a same row are connected with a same first plug-in card; and

a second connector array, fixed on the frame, wherein a second connector in the second connector array is connected with a second plug-in card, and second connectors in a same column are connected with a same second plug-in card; and communication cables, connected with the first connector array and the second connector array,

wherein the second connector array comprises base columns and extension columns, a number of base columns in the second connector array is equal to a number of base columns of the first connector array, the communication cables comprise a first cable group and a second cable group, when first connectors in a row are respectively connected with second connectors in another row, the first connectors are connected with second connectors in the base columns via the communication cables in the first cable group and connected with second connectors in the extension columns via the communication cables in the second cable group.

2. The cable backplane system according to claim **1**, wherein first connectors in at least two rows are connected in parallel with second connectors in another row via the communication cables.

3. The cable backplane system according to claim **1**, wherein a spacing between two adjacent columns of the first connectors is larger than a spacing between two adjacent columns of the second connectors.

4. The cable backplane system according to claim **1**, wherein the cable backplane system comprises two first connector arrays, the second connector array is located

between the two first connector arrays and connected with the two first connector arrays via the communication cables.

5. A communication device, comprising:

a device chassis, a cable backplane system, and a plurality of first plug-in cards and second plug-in cards; wherein a first plug-in card is connected with first connectors in a same row on the cable backplane system, and a second plug-in card is connected with second connectors in a same column on the cable backplane system;

the cable backplane system comprises:

a frame; and a cable unit, comprising:

a first connector array, fixed on the frame; and

a second connector array, fixed on the frame; and communication cables, connected with the first connector array and the second connector array,

wherein the second connector array comprises base columns and extension columns, a number of base columns of the second connector array is equal to a number of columns of the first connector array, the communication cables comprise a first cable group and a second cable group, when first connectors in a row are respectively connected with second connectors in another row, the first connectors are connected with second connectors in the base columns via the communication cables in the first cable group and connected with second connectors in the extension columns via the communication cables in the second cable group.

6. The communication device according to claim **5**, wherein the plurality of first plug-in cards are divided into two groups, the plurality of second plug-in cards are located between the two groups of the plurality of first plug-in cards, wherein the plurality of second plug-in cards are respectively connected with the two groups of the first plug-in cards via two cable backplane systems.

7. The communication device according to claim **5**, wherein the plurality of first plug-in cards are service cards, and the plurality of second plug-in cards are switch cards.

8. The communication device according to claim **5**, wherein first connectors in at least two rows are connected in parallel with second connectors in another row via the communication cables.

9. The communication device according to claim **5**, wherein a spacing between two adjacent columns of the first connectors is larger than a spacing between two adjacent columns of the second connectors.

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